MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017 / 2018

PEM0046 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation In Engineering)

1 JUNE 2018
3:00 p.m. – 5:00 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **FIVE** printed pages including the cover page.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary working steps **MUST** be shown.
4. Statistical table is provided.

Answer ALL questions [100 marks].

QUESTION 1 [25 marks]

a. A bag contains 5 white balls and 7 black balls. **Three balls** are chosen at random from the bag (without replacement).

Let X be a number of white balls chosen.

i. Construct the probability distribution of discrete random variable X. [6 marks]

ii. Find the mean of X. [3 marks]

b. Let the probability distribution function of continuous random variable X be defined as

$$f(x)=\begin{cases} k-x\ , & 0\le x<1 \\ kx-1\ , & 1\le x<2 \\ 0\ , & \text{otherwise} \end{cases}$$

i. Find the value of constant k. [5 marks]

ii. Find the probability that X is between 0.5 and 2.5. [4 marks]

iii. Find cumulative distribution function, $F(X)$. [7 marks]

Continued...

QUESTION 2 [25 marks]

a. Many primary care doctors feel overworked and burdened by potential patients' complaints. In fact, the Physician Foundation reported that 60% of all general doctors in United States **do not** recommend medicine as career. If 20 general doctors are randomly and independently selected, what is the probability that

i. exactly ten general doctors **do not** recommend medicine as career. [3 marks]

ii. from 5 to 15 general doctors recommend medicine as career. [2 marks]

iii. Find the mean and standard deviation for the number of general doctors that **do not** recommend medicine as career. [2 marks]

b. Suppose that radioactive particles strike a certain target in accordance with Poisson process at an average rate of **three particles per minute.** Determine the probability that

i. at most nine particles strike the target in a particular two-minute period. [1 mark]

ii. between four and nine particles strike the target in a particular four-minute period. [3 marks]

iii. exactly three particles strike the target in a particular one-minute period and more than four particles strike the target in the next particular one-minute period. [6 marks]

c. Extruded plastic rods are automatically cut into nominal lengths of 6 inches. Actual lengths of the rods are normally distributed with a **mean of 6 inches** and a **standard deviation of 0.06 inch.**

i. What is the probability that the length of the rod is within the population mean by 0.1 inch? [3 marks]

ii. What is the probability that the length of the rod is less than the population mean by 0.05 inch or more? [2 marks]

iii. What is the length of the rod that would be considered "within tolerance" if we define "within tolerance" to be the middle 60% of the length? [3 marks]

Continued...

QUESTION 3 [25 marks]

a. A corporation has five executives. The number of hours of overtime a week reported by each is

1	5	2	3	2

Consider all possible samples of **size three** which can be drawn without replacement from this population.

i. Find the mean, μ and standard deviation, σ of the population. [3 marks]

[Leave your answer in three decimal points]

ii. List all the possible samples of size three (without replacement) from this population, and hence determine the sample mean. [5 marks]

iii. Tabulate the sampling distribution of the sample mean in a table. [3 marks]

iv. If a sample of three numbers (1, 5 and 2) is selected from this population, what is the non-sampling error if we record 5 as 6 by mistake? [3 marks]

b. According to a National Business Travel Association 2017 survey, the average salary of all professional tourist guides in a certain country is \$97,300 with a standard deviation of \$30,000. Consider a random **sample of 50** professional tourist guides and let $\bar{x}$ represent the mean salary for the sample, find

i. $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$. [2 marks]

ii. the probability that the sample mean will be more than \$89,500. [2 marks]

iii. the probability that the sample mean will be more than the population mean by at least \$500. [3 marks]

iv. the probability that the sample mean will be less than the population mean by at most \$1,000. [4 marks]

Continued...

QUESTION 4 [25 marks]

The amount of a chemical compound y, which dissolved in 0.1 litres of water at various temperature x, were recorded as follows:

x (°C)	0	15	30	45	60	75	0	15	30
y (grams)	50	47	31	25	12	8	48	44	29

a. Draw a scatter diagram of y against x, on the graph paper provided. [2 marks]

b. Find the equation of the regression line. [15 marks]
Hence, graph the line on the scatter diagram.

c. Estimate the amount of chemical that will dissolve in 0.1 litres of water at

i. 55 °C. [1 mark]

ii. 80 °C. [1 mark]

iii. Compare your answer in part (i) and part (ii), which estimation value is more reliable? Give a reason for your answer. [1 mark]

d. Find the correlation coefficient between x and y and concludes the finding. [5 marks]

(Note: For Question 4, leave all your answers in 3 decimal points)

End of Page